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Abstract

This mcncgraph presents the raticnale for the develcpment cf a new instructional system; it is part of an effort, spcnsored by a ccnsortium of Utah school districts and the State Board of Education, tc intrcduce and implement a systems apprcach tc instructicn in Utah public schccls. The first half of the paper is a critique of the present instructicnal system which is described as obsolete because cf its failure to adapt to the effective use of available technolcgy. The cne-teacher, 30-student classrccm unit, supplementary professional staff, lecture and discussion teaching strategy, pressures for cost-benefit analysis, and rigidities which restrict inncvaticn are discussed. The remainder of the paper outlines a potential alternative designed to utilize more effectively the potential of teachers, programed learning materials, modern textbccks and printed supplementary materials, the computer, instructional televisicn, films, tapes, records, and cther audic-visual aids. Included are descripticns of (1) a staff structure with fewer professicnal teachers but mcre supplementary prcfessional and ncnprcfessicnal personnel; (2) an instructicnal media center and physical plant to utilize teaching packages and instructicnal team and individualized teaching patterns; (3) teaching strategies which employ three basic types of learning activities: tutcring; lecturing, explaining, and demonstrating; and individual study. (JS)

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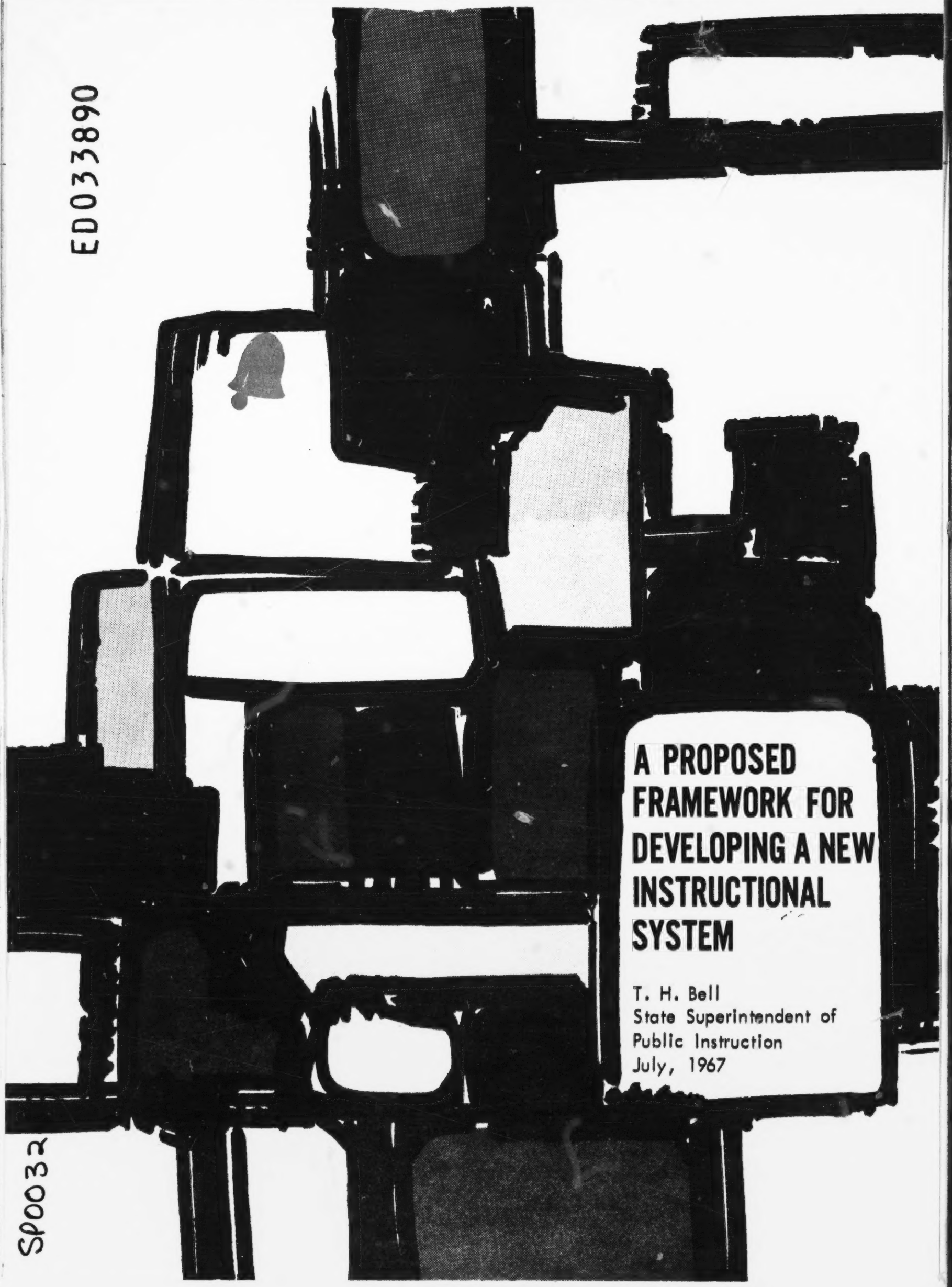

A PROPOSED FRAMEWORK FOR DEVELOPING A NEW INSTRUCTIONAL SYSTEM

T. H. Bell
State Superintendent of
Public Instruction
July, 1967

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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INTRODUCTION

A consortium of Utah school districts and the Utah State Board of Education is sponsoring a major development effort to introduce and implement a systems approach to instruction in Utah public schools. This program will develop a more comprehensive use of technology through a joint endeavor to build instructional systems packages that will enrich learning opportunities in a multi-media, man-machine system of teaching. Staffing patterns for instruction will be significantly altered. The traditional classroom teaching practice will be replaced with a more open, flexible arrangement for students, instructional staff and media utilization.

In the pages that follow the rationale for development of this new instructional system is presented.

A PROPOSED FRAMEWORK FOR DEVELOPING A NEW INSTRUCTIONAL SYSTEM

I. SYSTEMS THEORY AND THE INSTRUCTIONAL SYSTEM OF PUBLIC EDUCATION

A. Education as a System

At a conference on prospective changes in society and their implications for education, held in Salt Lake City in October of 1966, Dr. R. L. Johns, Chairman of the Department of Education, University of Florida, described social systems and educational organizations in some detail. Since his paper presents this complex concept very clearly it is quoted extensively below as an introduction to the discussion that will follow:

> "During the past fifteen years, behavioral scientists have developed some theoretical concepts which are quite helpful in assisting a state to evaluate its organizational arrangements and operational procedures for public education. One of the most useful of these concepts is general systems theory. Systems theory provides an important linkage among all the sciences. General systems theorists believe that it is possible to represent all forms of animate and inanimate matter as systems; that in all forms from atomic particles through atoms, molecules, crystals, viruses, cells, organs, individuals, groups, societies, planets, solar systems, even the galaxies, may be regarded as systems.
>
> "The school system is a complex social system, comprised of an aggregation of sub-systems and supra-systems interacting with each other and also with numerous other social systems in the total society. Our society can be described as a complex of social systems in interaction. How can we understand these complex inter-relationships and how should we deal with them? Fortunately, systems theory throws some light on this problem.
>
> "Every social system, if it survives, must come to terms with its environment. That is, it must exchange matter, information or service with the components of its environment to the extent necessary to meet the needs both of the environment and of the system. That is, the social system must meet the needs of its environment if the environment supports it. How does the social system know that it is meeting the

needs of its environment? It gains that information through what behavioral scientists call 'feedback.' Lonsdale defines feedback as follows:

> 'As applied to organizations, feedback is the process through which the organization learns: It is the input from the environment to the system telling it how it is doing as a result of its output to the environment.'

"If a system fails to learn from its environment, it will eventually fail to survive or forces in the environment will make changes in the system. On the other hand, the components of the environment cannot provide the school system with intelligent feedback unless the output-input of the system includes an appropriate interchange of information.

"These are rapidly changing times and educational social systems are receiving more feedback from the environment than ever before. Local school systems, state departments of education, and colleges and universities are receiving numerous urgent and valid signals from their environments calling for change.

"How does a state department of education, or a higher institution of learning, or a local school system, react when it receives criticism? Behavioral scientists have noted a number of reactions from social systems that have been disturbed by such feedback as a criticism. The social system may employ a number of alternate strategies in order to restore its equilibrium after a disturbance. Not infrequently a social system reacts as follows when it receives criticism: first, it ignores it; second, it denies it; and third, it attacks the source of the criticism.

"Thus it is seen the problem of establishing and maintaining educational organizations that are functional is not a simple one. The social system must change in order to survive in its environment. But the system cannot adjust to an unlimited amount of change at one point in time. These times, which require a rate of change greater than ever before, present an unparalleled challenge to the educational administrator to provide leadership for making desirable innovations and at the same time maintain a dynamic equilibrium."

B. CRITIQUE OF THE INSTRUCTION SYSTEM

The foregoing discussion of systems theory by Johns should lead to a critical look at the instructional system now in existence in our schools. If we can learn to look at the totality of our teaching-learning effort through the eyes of systems theorists, perhaps we can design a more sophisticated and effective system that will gain more for the dollars and efforts we expend. This, at least, is the theorem of this paper.

DISCUSSION OF THE CURRENT INSTRUCTIONAL SYSTEM

American public education has devised an instructional system that is quite simple. It has been effective in meeting many of the educational needs of our people for a number of decades. Changes and modifications have been made but the basic framework for use of the teaching staff, physical facilities, and instructional materials has remained essentially the same.

The current instructional system is comprised of a physical plant containing classrooms with supporting laboratories, libraries, shops, and gymnasia. The design of the plant has been dictated by the function. The function has been governed by the basic instructional unit. The basic unit, in turn, has governed the system design.

The instructional unit is currently comprised of a teacher (with supporting personnel to be described later), a group of approximately thirty students, and a classroom of approximately 900 square feet (standard of 30 square feet per student) equipped with chalkboard, textbooks, and supplementary equipment and supplies.

This unit functions under the leadership of the teacher. The strengths and limitations of the teacher and the physical facilities and instructional supplies govern, to a great extent, the efficiency of each particular unit in the system. With these elements making up the basic unit, the quality of educational output varies from one classroom to another.

The predominate instructional system places almost the entire responsibility for high quality, productive learning experiences upon the individual teacher. The teacher is in charge of (and almost totally responsible for) all of the essential factors that nurture learning for thirty students for an entire school year. Students,

then, must rely upon the good fortune (and the good management) of the school district to provide unusual individual teaching capability. This unusual capability demands a wide variety of talents in: (1) understanding the school curriculum, (2) mastery of teaching methods, (3) using and adapting a multiplicity of complex instructional media to provide variety and differentiation to meet the varying and different needs of students, (4) diagnosing learning blocks and difficulties and adapting techniques to such needs, and (5) teaching and tutoring small groups on an individual basis while, at the same time, using the time of all members of the unit as productively as possible.

Educators have doubted that any teacher can meet all of the above demands to a reasonable level of efficiency. Even the acquisition of knowledge of the subject matter on a level applicable to all learners in the unit is a great challenge. To also efficiently provide all the other outcomes of education above and beyond simple knowledge acquisition is a near impossibility for one teacher.

Subject matter specialization has led to secondary school and college departmentalized teaching where each teacher teaches in his field of strength and meets from five to seven groups of thirty students each during a school day scheduled into time period segments of about 50 minutes each. The departmentalized system results in one teacher functioning in a classroom unit. The difference is that each teacher teaches a separate subject to from 140 to 200 students in a school day rather than teaching all subjects in the curriculum in one classroom to thirty students.

Departmentalized teaching is somewhat impersonal. With about 160 students being taught by each teacher in each school day it is difficult to learn of and adapt to the individual needs and varying problems of each learner. Also, the situation is still predicated upon the need for a "super" teacher who can be many things to each and every student.

C. APPENDAGES . . . . THE SUPPLEMENTARY PROFESSIONAL STAFF

The classroom unit system of teaching demands more than most teachers can produce. This is so in the departmentalized unit where class groups change every fifty minutes. It is also true in the self-contained classroom situation typical in the elementary school.

Because of these apparent demands for an unusually capable person

in each unit in the system and because of the understandable limitations that many teachers have in measuring up to these demands, the classroom unit system of teaching has been supplemented with non-teaching professional personnel. These members of the school system's instructional team have been employed to provide support in plugging the more obvious gaps in the over-all efficiency in the system.

Specialists in educational diagnosis and counseling attempt to fill in for the "impersonal-ness" of departmentalized instruction of the masses. The school counselor keeps a record folder on each student for use of teachers. Test results and the complete educational history of each learner are kept in readiness for study and appraisal. Students are scheduled into the instructional system as a result of the expert knowledge the school counselor can bring to bear upon the study of individual needs. The counselor tries to see students as individuals and meet their needs as separate persons.

Remedial reading instruction is another example of supplemental effort to support the regular classroom unit system. The teaching of reading, for example, has met the needs of great numbers in past years. The exceptions stand out, however. We have non-reader dropouts. We have significant numbers of poor readers not equipped to move up the educational ladder. These are failures of our present system where too much has been demanded of the limited capabilities of teachers to meet the individual needs of all in a group teaching system in the basic classroom unit. We have sought to correct the mistakes and weaknesses of the basic system by establishing a sub-system of remedial teaching.

We also have employed specialists to teach the subjects requiring special talents and insights. Music and art are subject area examples.

The supervisors, counselors, librarians, subject area specialists, and principals all function in the present system. They have been added to supplement the efforts of teachers functioning in the basic classroom unit because of the inadequacies of the system we have used for so many years. These non-teaching and supplementary teaching personnel are expensive. They have evolved as sub-systems of the basic system out of necessity and concern for meeting the needs of all students.

As teachers deal with the frustrations of the demands of working

in the basic classroom unit system, pressure emerges to modify the size of the unit. We are told that quality education will come when we reduce class size from thirty to fifteen. Teachers must also have time to study, plan, and prepare for teaching. It is a fact that many public school teachers suffer from suffocation of student numbers demanding attention every period of the school day. It is hard to be a careful, thoughtful teacher when the weight of numbers constantly frustrate creativity.

D. TEACHING STRATEGY IN THE SYSTEM

Teaching on the secondary school and college level is comprised mostly of lecturing on the part of the teacher and listening on the part of the student. Class discussion, panels, and other variations occur, but the lecture remains as the chief approach to teaching in the current system. There is little time to individualize and to adapt to varied needs during a fifty minute period. This is emphatically true when a teacher deals with six or seven consecutive groups in a typical school day. For this reason lectures are prepared and repeated to the various sections of the same subject taught by the teacher functioning in the departmentalized system.

The school program clock begins and ends the lecture regardless of the interest level and possible optimum teaching moment that should be continued. The program clock, the lecture, and the rigid classroom unit are administratively convenient. Management problems are great even in this simple system. The complexity of a large secondary school makes the rigidity of the system administratively desirable. Tradition helps to maintain it.

Lectures are more effective if they have the added punch of certain means of illustrating key concepts. This would ideally require intensive preparation of various kinds of audio-visual aids. Illustrated lectures have all the obvious qualities of a rich presentation that enlarges upon the limitations of the teacher's voice, but such are costly in terms of time and resources expended.

Under the present system we therefore find little time for the carefully prepared illustrated lecture. Time and the weight of numbers work against us. We therefore lecture by voice with a minimum of illustration. Students are often passive observers in the classroom unit system. They sit as note taking spectators to the lecture phenomenon that pervades the scene before them. Educators acknowledge that there is too much passivity on the part of the learner. He

must be active, and must be responding to the situation if he is to learn.

E. PRESSURES FOR COST-BENEFIT ANALYSIS OF THE PRESENT BASIC INSTRUCTIONAL SYSTEM

The system described in the foregoing pages of this paper has been at least defensibly effective over the years. It is the basic structure for American public education today. It has been modified from time to time to meet the changing demands of great numbers of students attending educational institutions for increased periods of years.

The system demands added dollars as student numbers increase. As teachers justifiably demand increased salaries and decreased teaching loads the costs of education multiply. Taxpayer loads keep going up to meet quality and quantity demands. It is hard to justify decreased teacher loads because of increased costs and questionable return in terms of improved quality. The research fails to prove conclusively that achievement of students increases with decreased pupil-teacher ratios. In fact, some research would tend to refute this thesis.

Many authorities believe that teaching strategy fails to change when teachers accustomed to teaching thirty students are assigned to classrooms with 15 to 18 students. This phenomenon has been observed recently where Title I projects under ESEA have provided lower ratios. Most teachers continue the long established group teaching practice, and the results are therefore far from impressive.

As we increase teacher salaries under the present instructional system framework, we have little hope of offering dramatic increases in the output commensurate with the increases in the dollar input. As a result of the success of cost benefit analysis techniques used in business and industry, we face demands to guarantee more output when we demand more dollar input. The current instructional system cannot respond to this demand. It is rigid and costly. It ties teachers to the classroom group treadmill. It does not lend itself to creative adaptation to feedback calling for change. What is needed is a totally different basic instructional system.

F. INNOVATIONS RESTRICTED BY A RIGID SYSTEM

In recent years we have heard and read much about innovation

and experimentation in education. Instructional television has been introduced into the present basic instructional system. The basic instructional unit of the classroom system and the teacher has prevailed with ETV as an appendage or supplement to the system.

Exciting new approaches to organizing subject around some basic learning theory has resulted in the introduction of programmed learning theory has resulted in the introduction of programmed learning and teaching machines. A learning program is a body or unit of subject matter organized in such a manner as to make it possible for the subject matter to teach itself to the learner. The level of sophistication in writing effective programmed learning units is gradually increasing. It appears that we have succeeded in organizing subject matter so that it does have at least some limited value in successfully teaching itself to the learner. We have, however, introduced programmed learning as another innovation tied to the basic classroom unit system.

Audio-visual aids such as audio tapes, small video tape units, records, film strips, motion picture films and many other devices and combinations of these devices have been invented and used in schools. These devices are available to the classroom teacher in the basic instructional unit system, but he cannot free himself from the daily pressure of student numbers and time schedules to prepare them for use in his teaching. He is tied to too much routine, too many schedules, and endless groups of thirty students constantly before him in his classroom situation.

The National Education Association has recognized this problem. It is encouraging to see this organization call for a supportive staff to serve under the direction of the teacher. Whether this should be done in the traditional classroom setting is, however, subject to question. (More attention to this appears elsewhere in this paper.)

Computers are coming into the instructional picture. Information about students, test scoring, pupil error analysis, student class schedules, and many pupil personnel analysis and service functions can be facilitated with the computer. Subject matter is being programmed for student-computer interaction. The use of computers in the totality of education is almost limitless. As we look at the present basic classroom unit system we again bump into the circumstance of the heavily burdened teacher in a rigid classroom unit teaching situation. We must begin to wonder how the teacher can extend his talents and capabilities to the use of the computer in his classroom when he is already burdened beyond usual capacity.

Knowledgeable persons acquainted with the potential of computers claim that these machines will extend and add to man's intellectual power in a manner that may parallel the extension of man's muscle power through the use of work producing machines. This has enormous implication for education. Although we do not have the extent of computer involvement in education we can safely predict that teachers in future years will be using computers extensively in their day to day work.

Libraries supplement the textbooks in modern schools. Subject matter is expanding rapidly, and it requires endless effort to keep up with the growth in printed instructional materials. Educational offerings are enriched considerably by the resources of printed materials of all kinds found in the library. Library functions are being expanded to include comprehensive media centers.

Libraries and computers present the potential of dial access information systems where lectures, books, and special units of information are available through electronic storage and retrieval. Through use of computer actuated information systems we will soon have talking books and illustrated lectures on electro-magnetic tapes, discs, and in data cells. The possibilities are great and the potential is exciting. The rigid classroom unit system looms increasingly as an obstacle to full fruition of this potential since the system was not designed to accommodate the complexities implied.

These are feedback signals that call for the system to change. As Johns has indicated, we have been ignoring the signals. In some cases we have pretended to change but have not really done so. In others we have made adaptations to the present classroom unit system but have not really changed the system.

What is needed, as we think of the future demands and potential of education, (in this era of technology applied to problems of teaching and learning), is an entirely different instructional system. It seems safe to conclude that the basic classroom unit system - good as it has been in the past - must give way to a more flexible and sophisticated system of instruction.

Following is a proposed model of a new instructional system. It is a tentative proposal, but it is a beginning. The re-design of a totally new instructional system is an enormous task. We should not,however, shrink from at least a modest beginning just because the problems are complex. We don't have to change all of our

schools at once, but we must respond to the ever increasing and strongly compelling indications that educational technology has outgrown our present instructional system. We should proceed with the assurance that the probabilities seem fairly high that even a crudely designed new system will surpass the one we have.

II. A NEW INSTRUCTIONAL SYSTEM FRAMEWORK

A. SCOPE OF THE PROBLEM

A new system should provide a teaching capability that will utilize more effectively the potential of teachers, programmed learning materials, modern textbooks and printed supplementary materials, the computer, instructional television (both broadcast and local unit video tape), films, tapes, records, and other audio-visual aids. The variable learning ability of students calls for utilization of instructional media with many components.

We need to re-deploy the funds expended for instructional personnel resources in education so that learning can be individualized to meet varied human needs and more optimally develop varied student potential. In order to do this, the instructional staff of a school must include a broader span of specialization in media utilization and also in educational diagnosis than presently exists. The teaching staff personnel structure must include more technicians, clerks, assistants and aides capable of bringing the potential of educational media technology directly in focus upon the individual learner. We should change the ratio of certificated teachers to students from 1 to 25 or 30 to 1 to 45 or 50. Staff dollars should be re-deployed to employ assistants to support the teacher in the new system.

The size of the student group must be flexible. The nature of the learning activity should determine the number of students involved. It may involve the use of a simple textbook or a sequence in a carefully prescribed programmed learning unit. It may involve a video taped lecture, in color, specially prepared to introduce broad new concepts in a new unit of study.

The problem, therefore, extends itself to physical plant and equipment capability. A key to this capability is an instructional media center.

The instructional media center will serve as the heart and nerve center of the plant. The computer will store information about each learner and maintain constant retrieval access to teachers. It will also be available to store information about thousands of types of learning units available on audio or video tape -- or in programmed learning form -- or in simple printed form. As research extends itself further the computer will be used in some direct learning interaction with the student as computer based instruction becomes a reality in our schools.

In establishing this system we should train instructional staff personnel -- and especially professional teacher leaders -- to utilize the potential of various physical components of the system. This will involve a change in staff structure and expertise.

B. STAFF STRUCTURE

The proposed new system will employ fewer professional teachers. The professional teacher-pupil ratio will be increased to possibly 45 to 50 students to one teacher. The staff salary monies will be re-deployed to add the needed technicians, clerks, assistants, tutors, and aides that will comprise the staff structure of the new instructional system. School counselors, psychologists, remedial teaching specialists, supervisors, and librarians will be utilized in a different manner. Staff dollars in these areas will also be re-deployed.

The school will have a staff for the instructional materials center (which will supplant the library by housing all of the materials and equipment used in teaching). The staff of the instructional materials center will supplant the present counselor, librarian, remedial teacher, and supervisory personnel assigned to the school under the traditional pattern. The school will also have instructional unit staffs. These will replace the grade level teachers in the elementary school and the departmental staff in the secondary school. They will perform their duties in teams, functioning in instructional sub-centers clustered around the central instructional media center. Their activities will draw upon support of the personnel housed in the instructional media center. The total staff potential of the instructional units plus the school-wide staff potential of the instructional media center specialists will be brought to bear upon the learning process. This is the key to the proposed new system which holds the promise of more flexibility.

The potential of such a staff structure to provide a greatly enriched, multi-media program of instruction should greatly surpass the potential of a single teacher functioning in a separate, isolated classroom housing thirty children. The flexibility of staff deployment and the capability to utilize all of the potential of a more complex instructional materials and instructional machine technology will also greatly surpass the capability of individual teachers in the traditional setting. The new staff structure will be trained to effectively use computers, video tapes, other electronic teaching aids, and programmed learning units. This should truly individualize teaching and bring to greater fruition the abilities of a total instructional staff of broadly varying talents.

To attain these complex aims of staff comprehensiveness in utilizing highly sophisticated instructional media systems, orientation and training will be essential. Persons willing to part with tradition and think in terms that depart from the egg-crate classrooms and corridors will be essential in building the new system. Pilot programs must establish the new staff structure patterns. The new systems design can then be spread to additional school units.

C. A SAMPLE SCHOOL STAFF STRUCTURE

To illustrate further the possible staff structure and personnel dollar re-deployment, let us consider a middle grade school designed to teach third, fourth, fifth, and sixth grade pupils. The basic unit for instruction will be comprised of 90 students housed in a large, open instructional area next to the media center. The new instructional system would include four instructional staff units (one for each grade or age level). It would also include an instructional media center staff.

Duties of members of instructional unit staff:

a. Head Teacher - Leader and director of the work of of the unit...conducts meetings of the staff where planning is done -- supervises all members of the unit and coordinates their work -- will require a very able person with organizational and leadership ability...salary should be high enough to attract ability and compensate for added responsibility.

b. Experienced Teacher - This person would provide professional teaching service to students under the

direction of the master teacher. He would utilize the services of tutorial assistants and aides in individualizing instruction. Assistants and aides would perform duties assigned to them by professional teachers. The teachers would free themselves of most routine work not requiring skills and insights of a high professional level. The lecture type of teaching in groups of 30 or more would be very seldom done. Most learning would be in small tutorial groups of three to eight students and as individual students in self study or working with one adult staff member.

c. Tutorial Assistants or Intern Teachers - These persons should be para-professionals with at least two years of college training. They should be interested in becoming teachers. The positions may, in fact, be filled with teacher interns or college students working toward a degree in education. The positions may be filled with four half-time students or two full-time para-professionals depending upon availability of candidates.

These persons should provide a great amount of small group subject matter practice and drill activity to intermediate grade children working to master the rudiments of the basic tool subjects. They should, under the direction and assistance from the professional teachers, provide individual help to children who frequently have learning problems in group teaching situations.

d. The Volunteer Aides - Will serve on the staff out of motivation to contribute to their neighborhood school. Volunteer service to hospitals and neighborhood youth centers has resulted in a great deal of assistance to the public good. Many mothers endowed with a love for children and a desire to contribute to the cause of education of youth may be recruited to fill these posts. Personality characteristics that assure an attitude of service under the guidance of professionals will be important in recruiting these people. Some college background will be desirable, but intellectual ability to follow instructions and render teamwork assistance will be important.

A modest compensation for expenses in being away from home and in traveling to and from school should be provided.

The intent should be to reimburse for out-of-pocket daily costs and not to provide a salary.

The volunteer aides should correct papers, prepare teaching materials, respond to on-the-spot needs of youngsters, supervise playgrounds, hallways, and school lunch, check on children to lend assistance during study time, pass out materials, and serve as a personal assistant to the professional teachers. The services of these persons should be a great value to the total unit, but this will be so only if their potential is fully utilized by the teachers. Training and orientation will be crucial. They will need to understand the limitations as well as the potential of their work.

The school should honor and recognize publicly the persons who support education through volunteer service as aides to teachers. If this is properly done, reasonably capable talent can be recruited and a reservoir of applicants can be maintained. Orientation and training of volunteer aides will also be necessary if they are to function well in the system.

e. Clerk-Pupil Progress Accountant - This person will do clerical work for the unit. She will do the detailed accounting necessary in a system where individualized instruction encourages variable progress. She will also work with the person in charge of the computer input-out-put terminal located in the instructional materials center. The paper work of the unit will be computer assisted, and she will be the liaison person for the unit, updating progress data of individual students and retrieving from the computer system the information required by the professional staff.

D. COMMENTS ON STAFFING STRUCTURE FOR THE INSTRUCTIONAL UNIT

The number of professional teachers is reduced substantially from those required in the traditional system. The professional teacher-pupil ratio is therefore increased from 27 to 1 to 45 or 50 to 1. However, the number of adult members of the staff will be increased to provide the supporting services from the instructional media center. Thus, the new staffing structure will provide more personnel, or varying levels of ability, to make it possible to individualize the instruction for each one of the pupils in the unit.

The result should be the elimination of lectures and busy work for students in group teaching situations. Students should be more productively engaged in a personal involvement circumstance most of the time. The effort should be to keep the learner active - not passive - during every hour of the school day. The responsibility for learning should shift from the teacher (under the traditional system) to the learner. He will be the one engaged in programmed learning units, in small group discussion, and in tutorial type of activities. His constant, active involvement in learning should emerge from a more varied program of individualized teaching and learning.

The variability of the staff and the enriched materials and media environment should result in some release from the pressure of 30 students that constantly faces the teacher in today's system. The variability of staff should cause more attention to be drawn to learners with special needs. Extra tutoring can be provided either by a professional teacher or under the supervision and prescription of a professional teacher. Situations of non-response to learning stimulus should be much less frequent. Teachers will not be compelled to permit non-learning situations to be unattended because of the constant pressure of 30 students six hours each day with the <u>total</u> learning responsibility on one person's shoulders.

The new staffing structure is contingent upon effective volunteer aides supporting the professional teachers and the availability of effective tutorial assistants. Such assistance should be forthcoming if care is exercised in selection and if proper orientation is given to the role of these persons.

The staffing structure dramatically reduces the number of professional teachers. This should not concern members of the profession since demands for teachers are not being met at the present time. The great length of time required to develop a new instructional system (and cause it to become operative in significant numbers of schools) should provide further reassurance that this proposed re-design of the system will not result in teacher unemployment. When the teacher supply is greater increased preparation and periods of internship can also be required of new teachers entering the profession.

The taxpayer should welcome a new system that makes it possible for teachers to earn for themselves a very significant salary increase by being more effective in educational output without more

total dollar input. If the system becomes increasingly effective with continued experience, the flexibility in using technology and staff should provide education with a potential to individualize teaching for each student and meet the demands of increasing student numbers. Teachers will be more productive in terms of numbers of students served, and this should make substantial salary increases possible.

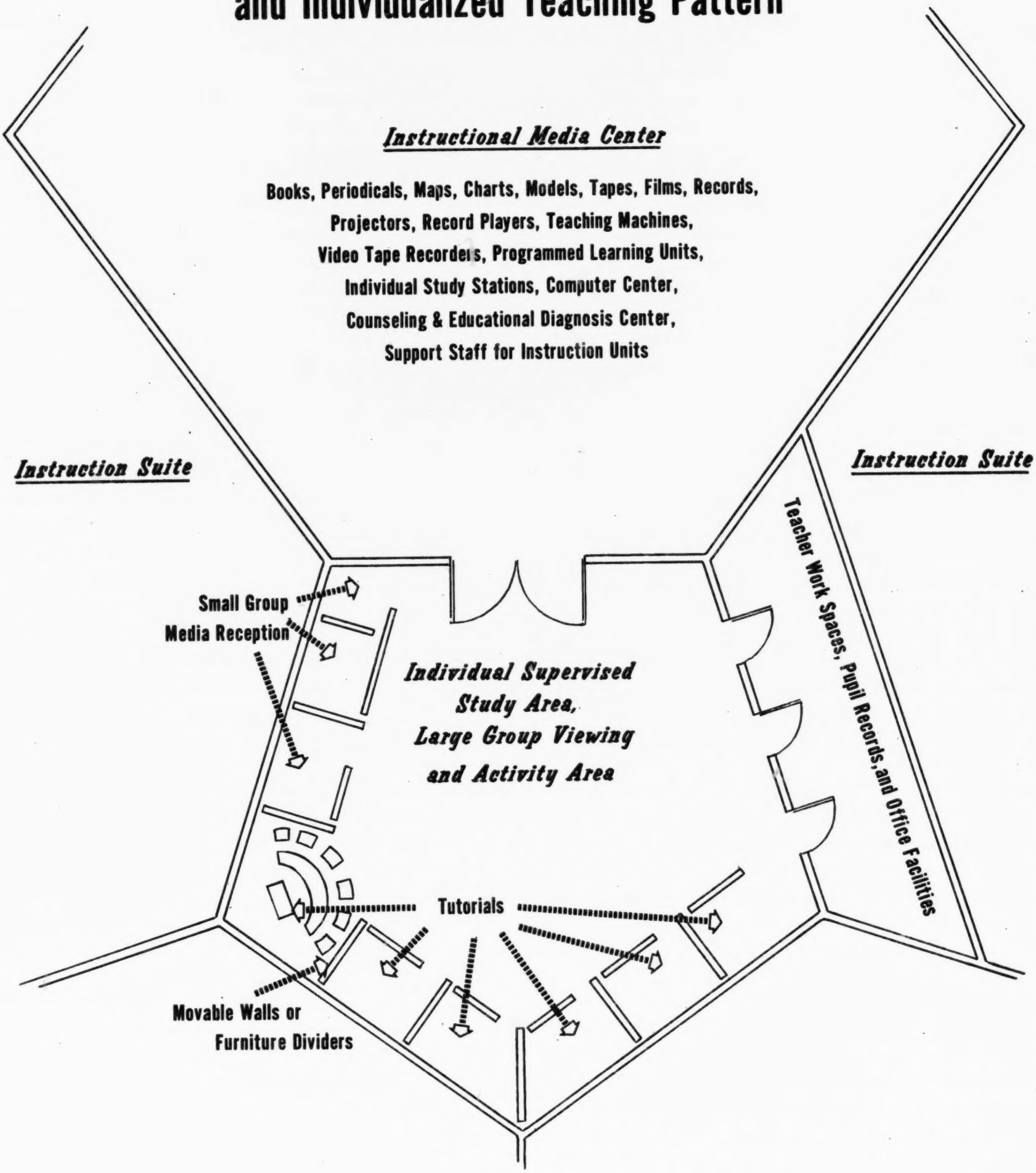
Much experimental and pilot study evidence will be needed to prove a theorem that educational productivity and dollar costs can be simultaneously increased in the former and held constant in the latter. Our hope lies in this and other system re-designs and not in perpetuating the present rigid and costly system that has difficulty adapting to demands or technology. Projections of dollar costs alone should give great impetus to developing a more efficient system.

E. THE INSTRUCTIONAL MATERIALS CENTER AND THE PHYSICAL PLANT

As previously stated, the proposed new instructional system is predicated on the availability of programmed learning units, video tapes, films, audio tapes, books, printed enrichment materials, and the coordination of the complexity of materials, staff time, and pupil needs through use of computers located in a central place but with remote terminals in the IMC of each school. Effective use of instructional materials systems packages in the instructional units will be contingent upon the staff and logistical support of the IMC. The new instructional system will be housed in a school plant where the IMC is the heart of the school and the instructional units (replacing square classrooms with rigid walls) will be "wrapped" around the IMC. Spaces will have to be variable in size to accommodate flexibility required by the system. Thus, students and staff will flow from instructional units into the IMC and materials and machines will flow from the IMC to the instructional units. The mission of the IMC is to provide materials, equipment, and all the tools of learning to the instructional units and to provide computer assistance and back up to the units. (See attached sketch for IMC - instructional unit space relationships.)

It is anticipated that instructional systems packages designed on the State and school district level will be placed in the IMC of each school. Training unit staff members in the development and use of the systems packages will be part of the complex process of establishing a new instructional system. Video and audio tapes by

Possible Space Layout for Instructional System Facility to Utilize Teaching Systems Packages, Instructional Team Staff Pattern, and Individualized Teaching Pattern



thousands should eventually be developed for availability as part of the total resources of the IMC system. Programmed learning units varying in size and length from 50 to 5,000 frames should be stored in readiness in the IMC.

By bringing the instructional power of multi-media to teaching a given unit or segment of subject matter we can hope to gain in learning efficiency. (Teaching should be more effective, for example, when audio tapes, short video tapes, several different programmed learning sequences, and a number of printed illustrations are available to a teacher presenting concepts to students on objective and nominative case in English grammar.) A wide range of selection should be available through designing instructional systems packages of this sort that add richness and variety to the teaching strategy to be employed. This should be in sharp contrast with textbook reading and lecturing in the traditional setting.

The computer should extend the memory and intellectual capacity of the staff. Information about each learner in the unit and data about all the materials available for teaching on all levels and in each subject area should be stored in the computer memory and made available for instant retrieval. Test scoring and diagnostic support should also be provided by computer. Future dial access information systems and computer actuated learning programs should add to the value of the computer as a vital part of the new instructional system.

It is intended that dollars released from each instructional unit and the re-deployment of librarians, counselors, school psychologists, subject matter supervisors, assistant principals, and remedial teachers will provide the resources for a director and staff for the IMC. Expertise will need to be developed from experience and feed-back from the units.

The IMC will be a combination library, audio-visual laboratory, computer center, film and tape library, and counseling center. The center's mission will be to lend support to the unit staff and to provide individual study spaces for student viewing and studying.

SOME TENTATIVE IDEAS CONCERNING TEACHING STRATEGIES

BASIC PURPOSE

It is almost universally accepted by educators that the ideal situation in education is to have complete individualization of instruction. This has, of course, been

prohibitive in the past because of the costs involved. That is why the traditional school situation assigns from twenty-five to thirty children to a separate classroom to receive instruction from one teacher. The staffing pattern and the availability of educational technology housed in a school plant that breaks with traditional classroom teaching design all make it possible for an instructional system to be developed that will facilitate more individualized teaching. The instruction, to be sure, will not be totally individualized but it will be infinitely more personal and more carefully geared to individual differences than has been so in the past.

Let us examine a possible teaching strategy utilizing the staff pattern suggested in this paper. This proposal would also use the basic instructional unit previously suggested. It would be housed in a large instructional suite immediately adjacent to an effectively functioning instructional media center.

STUDENT LEARNING ACTIVITIES

It is suggested that this new instructional system might begin through experimentation with three basic types of learning activities for students. These are: (1) tutoring, (2) lecturing, explaining and demonstrating, (3) and individual study. It is intended that practically none of the instruction will be offered students in groups of traditional classroom size. The instructional sub-group should usually vary in size from three to ten students.

Much concern is being expressed today about problems of student identity and de-personalization. The teaching strategy suggested would tend to draw the instructional staff closer to students as individuals. Small tutorial groups of from three to ten learners would make this possible. Staff teamwork in directing individual study activities and in utilizing audio-visual technology in individualized and group information presentation will make it possible to more productively use the time of students while they are not participating in tutorial sessions.

The most important learning activity would take place in small groups of three to ten students receiving personalized tutoring from a professionally trained teacher. By limiting the size of the group to not more than ten the contact with each learner will be quite personal so that the teacher can in fact adapt to individual needs as they are diagnosed from the close range of instruction on this intimate basis. This tutoring activity is the kind of instruction that has yielded dividends for years in the primary grade classroom. It has been the practice in primary grades in the past to establish small reading circle groups where the interaction between the teacher and the learner is very intimate and individualized. It is intended that most of the professional teacher's time in the new instructional system will be devoted to this type of tutoring activity.

The great advantage in this proposed system will be that manpower and educational technology will be available under the new system to keep the learning activities of students (not involved in tutoring sessions with professional teachers) more productively directed toward follow-up activity assigned by the professional teacher as an outgrowth of continuous daily interaction between the teacher and the learner.

The teaching activity will shift to individualized tutoring in small groups rather than lecturing and group teaching in the classroom. It is suggested that the professional teachers would be assisted by tutorial assistants. The tutorial assistant would be a para-professional or a teacher trainee-intern completing requirements for full teaching certification. The tutoring done by the tutorial assistants would be structured and supervised by the professional teacher. Theirs would be follow-up activities to small groups in providing added assistance preparatory to individualized study. This will provide the professional teacher with supporting follow-up activity without using valuable professional staff time for this type of sub-professional teaching activity.

INDIVIDUALIZED STUDY

It is anticipated that the new instructional system will provide more time for supervised individualized study and independent individualized study. Students will receive an assignment from the teacher that grows out of the tutoring sessions. Members of the instructional team will supervise groups of students as they work on these assignments in supervised study sessions. The students will also be provided an opportunity to do some studying on their own in the instructional media center.

The supervised study will provide opportunities for some structuring and for some assistance as children work on assignments. This will, of course, require coordination between the team member assigned to supervise the study activities that are to grow out of the tutoring sessions.

The independent study that will take place in the instructional materials center will provide opportunities for students to pursue special areas of interest on an enrichment and supplementary basis. The materials available to the staff in this center will focus attention on learning activities related to the age group and the specific instruction taking place in the various instruction units of the school. The amount of independent study time prescribed will vary with student sub-groups according to needs and capabilities to study independently.

Through the independent study and the supervised study activities students will be gaining more independence and responsibility for much of their educational growth and development. This should result in sound study habits and in self-

reliance. Such activities, constantly followed up by tutoring sessions, should be highly productive if the right types of enrichment materials are made available.

LECTURING, EXPLAINING AND DEMONSTRATING

The current state of educational technology makes it possible for us to develop hundreds of small video tape clips, motion picture films, audio tapes, records, and other types of information conveying materials. By accumulating and developing a rich and varied array of these materials and by providing the technological means of making them almost immediately accessible to small groups of students, the viewing and listening activities can take the place of most of the teacher lectures that have been so prevalent in American education. The new staff pattern will make availability and immediate use possible. This will take place in listening and viewing centers with earphone sound control. (See sketch of proposed physical layout on a previous page).

Great care should be taken to have carefully prepared video tapes or 8 mm single concept films, for example, that will relate specifically to certain sub units of instruction related to basic subject matter covered in the small group tutoring situations. If these are prepared with care they can be utilized hundreds of times as part of the total instructional system. With continued experience, the coordinated use of these and other means of communicating ideas and information should become increasingly effective.

Instead of using the teacher's voice before a traditional size group to introduce new units of learning activity (and to stimulate interest through orientation to sub-units of subject matter) it is anticipated that electronic projectors and video tape units will convey this information from pre-packaged systems. Their use will need to be carefully identified and limited to the total instructional plan. If they are well done they will exceed the capability of a teacher who lectures on a day to day basis in the traditional classroom. Each unit will have voice, music, and action capability that should attract and hold attention.

This type of learning activity has its limitations since the learner will not want to view and listen for endless periods of time. Such activity, with its limited value in the total learning situation, will be subordinated to the tutoring and individualized study work that will be going on in the total instructional process.

PROGRAMMED LEARNING AND SYSTEMS MATERIALS FOR INDIVIDUAL STUDY

Programmed learning units would also be provided from the instructional media center as part of the orientation and information acquisition activity. The use of programmed learning could also be classified under independent study activity. These units will convey information and can also provide goal directed practice

and drill in an independent study situation. Programmed learning should have a place in the total instructional system and should be a vital part of the instructional materials systems package. Through limited and wise use the advantages of programmed learning can be gained for the benefit of students. Only through recognition of limitations, however, will these advantages be gained without also bringing some disadvantages into the total learning picture. Like audio-visual learning activities, endless use of programmed learning units will result in loss of interest and waste of student time if use as a means of instruction is not varied with other activities.

Single concept films and materials for individualized study and inquiry should be made a part of the new systems approach to teaching. Study time will be more productive if a multi-media, independent study system is planned, equipped and staffed.

SUMMARY

The instructional staff, and especially the professional teacher-leader, will need to be thoroughly familiar with the content of all the multi-media instructional sub-systems packages that will be conveyed electronically by programmed learning, and by conventional media to the students. The media specialists, the teacher aides, and the clerical personnel can carry out the work done in individualized study, in orientation, and in information acquisition activities if such is done under the immediate surveillance and supervision of professional teachers. This will require careful coordination. Efficiency should increase with experience and with continued practice.

The total instructional strategy will be based upon cooperative activity where tutoring, individualized study, and information acquisition from pre-packaged lectures are facilitated by the staff through use of multi-media and through use of team methods that are geared to small student groups in tutoring and discussion situations.

Student grouping will be flexible to accommodate continuous progress and to promote maximum learning to the unique and varied potential of each individual. The grouping structure should provide for frequent review of student progress. Re-grouping should therefore occur often as individual educational needs may prescribe. Computer science should assist the professional staff in this task.

The time of the professional teachers will be directed toward the most highly productive part of the teaching and learning activity. This is, of course, the inter-action that goes on between the learner and a highly skilled teacher in a close personal learning situation. This will be facilitated in this type of instruction system to a much greater degree than has ever been possible in the traditional teaching situation. Achievement gains should be superior to what we have had in the past. Student failure and need for remedial work

should be decreased dramatically. This may not occur until the new system is developed with all of the related materials having been carefully prepared and with the staff having sufficient experience and practice in a new situation to learn to master the techniques and strategies and to gain confidence and enthusiasm for them.

Schedules and routines would need to be established and many varied approaches to developing the new system would undoubtedly be tried and rejected for more promising activities. Only through continued and sustained effort over a period of time sufficient to develop staff expertise will the proposed new instructional system receive a fair trial. This may require a year of preliminary preparation and three to five years of trial use with ample opportunity for revisions, changes, and re-development of new results. The actual teaching strategy would have to be based on feedback gained from experience. The problem is to avoid denunciation of the new system before it has had time to become rooted into solid educational practice. At this point, a very careful and intensely analytical appraisal of the progress of students should be taken by impartial evaluation experts.

III. CONCLUSIONS

This paper has attempted to discuss the current instructional system and describe the reasons why it will become increasingly obsolete because of available technology and the failure of the present system to adapt to its effective use. By looking at the need for change from the perspective of systems theory it is suggested that the entire teaching and learning program can be viewed more in its totality and less as single classroom components.

The specifics presented in this paper (as to staff, school plant, and media) were stated as a means of communicating a somewhat complex alternative to the present system. These specifics may not be the best, and modification in the proposed model would surely come after the benefits of more intensive study of other alternatives were attained. The writer does not claim the proposed new instructional system as his invention nor as even the theoretical best fitted for trial use. It was his intent, rather, to contrast the potential of a more open and flexible system with what we now have. Thoughtful criticism will surely add and delete to these proposals.

The chief consideration should be that our public school system - on both the public school and higher education level - should begin to more aggressively experiment with some drastic departures from the egg-crate classroom building and the rigid one teacher (or professor) and thirty student arrangement.

A theorem is a statement that is to be proven to be true. The writer's theorem is that our present instructional system is obsolete and that we can design a better one.